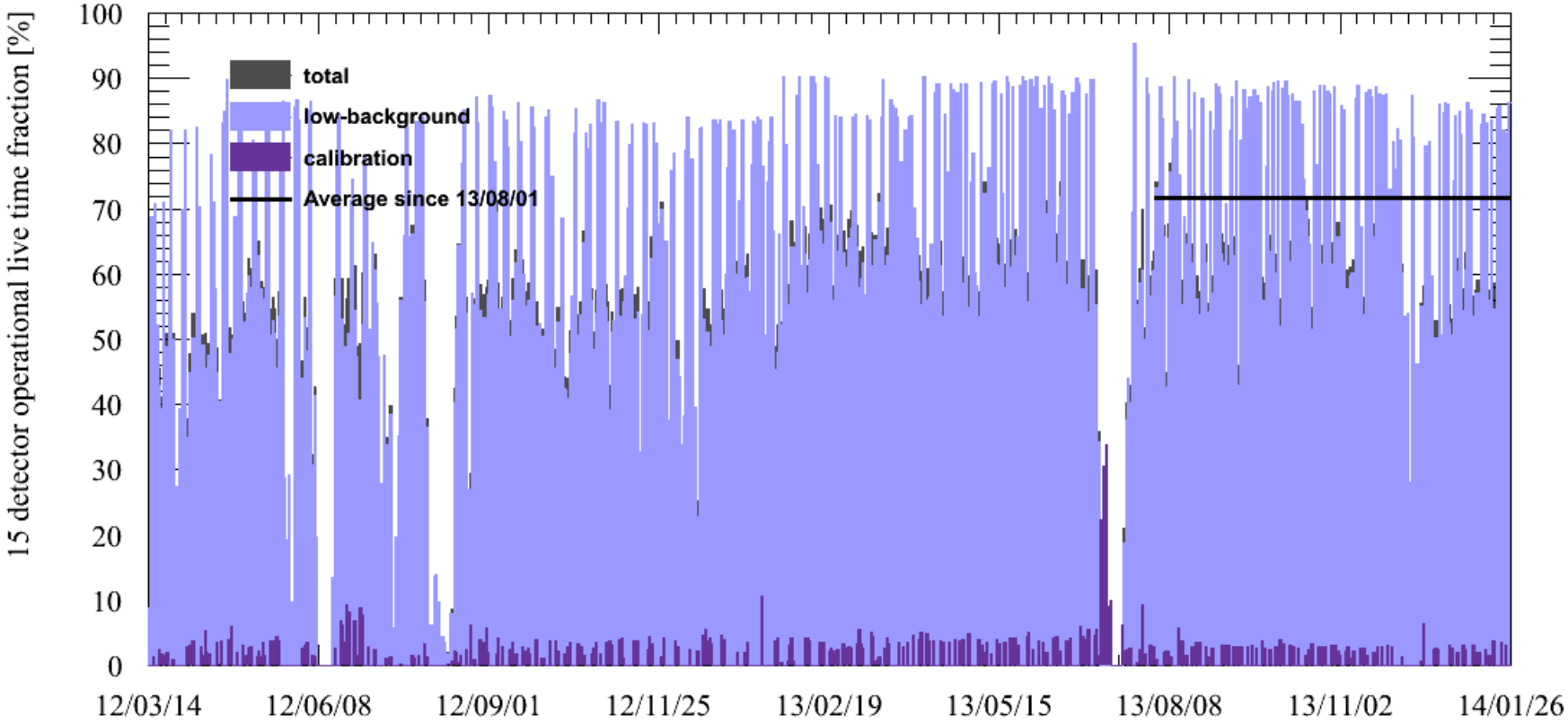
Cosmic Frontier Experiment Status

January 27, 2014

Experiment	Location	Status	Start of operations	Nominal end of operations	Physics
SuperCDMS	Soudan	Operating	Mar 2012	Mar 2015?	Dark Matter
COUPP/PICO 2L	SNOLAB	Operating	Dec 2013	Dec 2014?	Dark Matter
COUPP/PICO 60	SNOLAB	Operating	June 2013	Dec 2015?	Dark Matter
Darkside 50	LNGS (Gran Sasso)	Operating/ Calibrating	Jan 2014	Dec 2016?	Dark Matter
DAMIC	SNOLAB	Operating	Dec 2012	Dec 2014	Dark Matter
Dark Energy Survey	CTIO, Chile	Operating	Sep 2013	Feb 2018	Dark Energy
Pierre Auger	Argentina	Operating	2008	2015 (for FNAL)?	High Energy Cosmic Rays
Holometer	Meson Lab	Commissioning	Spring 2014	2015	Spacetime

SuperCDMS Soudan

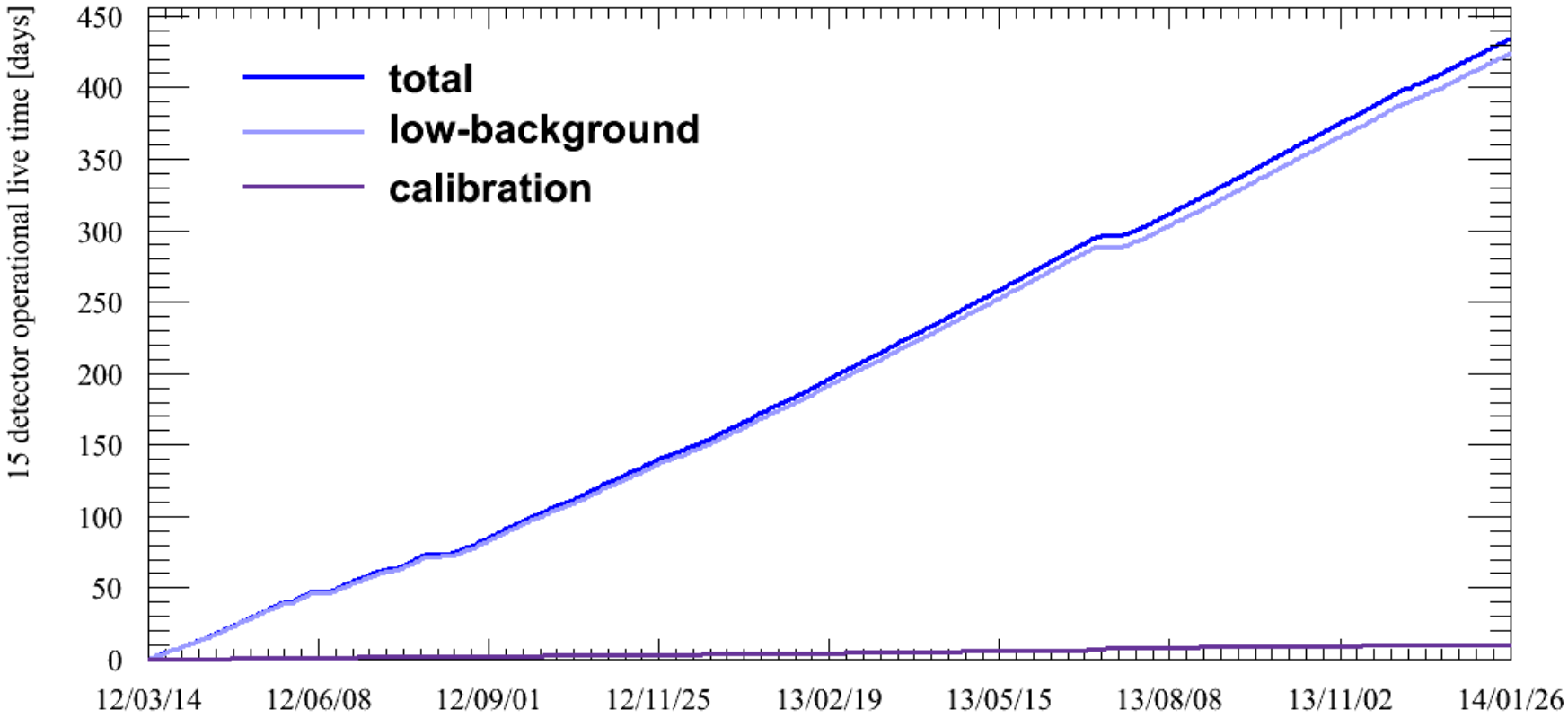


Calibration with gamma and neutron sources takes about 10% of live time, detector neutralization takes another 10% of live time, and maintenance/ special runs account for the remaining 5-8% deadtime.

Full recovery of all cryogens (LHe and LN) with reliquefiers

SuperCDMS Soudan

(cryogenic, not just cold)



Integrated live time (days) since beginning of operations
Detector mass is approximately 9 kg Ge, so exposure ~11 kg-years

Recent air temperature record: -44F (a balmy 219K)

Dark Energy Survey

(1st observing season)

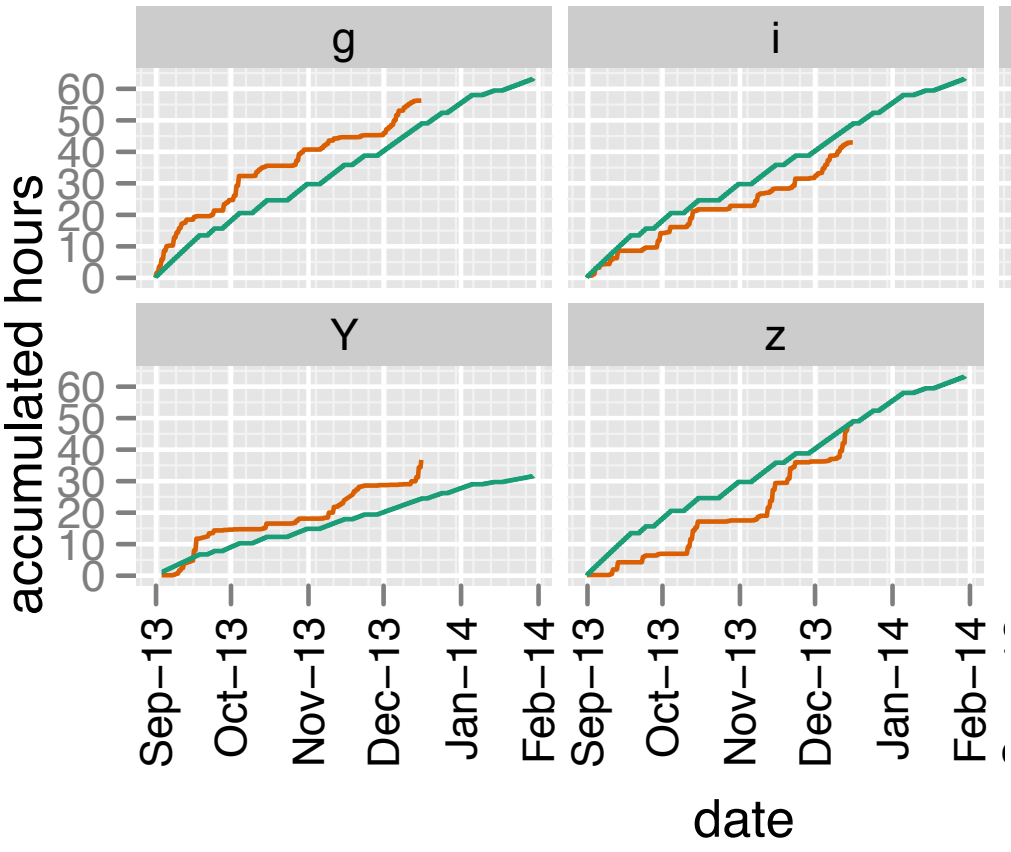
Operational statistics from the December monthly report by Tom Diehl

Activity	% this month	% of year 1
Observing time	94.5	82.1
Engineering	0	0
Bad weather	3.7	12.2
Telescope issues	1.0	2.4
DECAM issues	0.8	3.1
Observer error	0	0.2

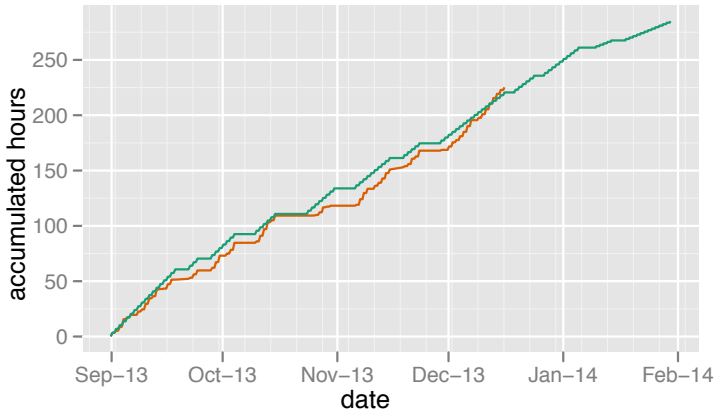
Weather and telescope issues have improved a lot since September
First season of the survey ends in mid-February

DES Wide-Area Survey Progress

As of Dec. 16



Note: g, Y, combined curves will come down with new DESDM assessment



All filters combined

Green: target to complete survey, assuming constant efficiency
Red: actual so far

DAMIC – Dark matter with CCDs (learning how to reduce backgrounds)
(FNAL, UChicago, UMich, Mexico, Argentina, Paraguay, Zurich)

- December-2012:
  Installed at Snolab with ~10g of active mass using DECam engineering CCDs.
- Early 2013:
  Ceramic board used for CCD package showed higher background than expected.
  Developed a new package with less ceramic to confirm the origin of the problem.
  Intrinsic background on CCDs is not a problem (from alphas).
- Summer 2013:
  Installed new package at Snolab with less ceramic.
  Measured expected improvement in the background.
- Fall 2013
  Developed a **ceramic free CCD package**
  LBNL provided **thicker CCDs** (x5 the mass of a DECam CCD)
  Packaged 6 detectors on ceramic free modules.
- February 2014
  Installation of new modules at SNOLAB
  ~10g of active mass with no ceramic
  Expect a factor of 50 reduction in background

  DAMIC-100 detector order in place for a 100g array [DECam only 70g =)]. If prototype packages demonstrate success -> 100g detector in operation during 2014 to probe CoGent/CDMS region… and even lower DM masses.

Holometer Commissioning Status

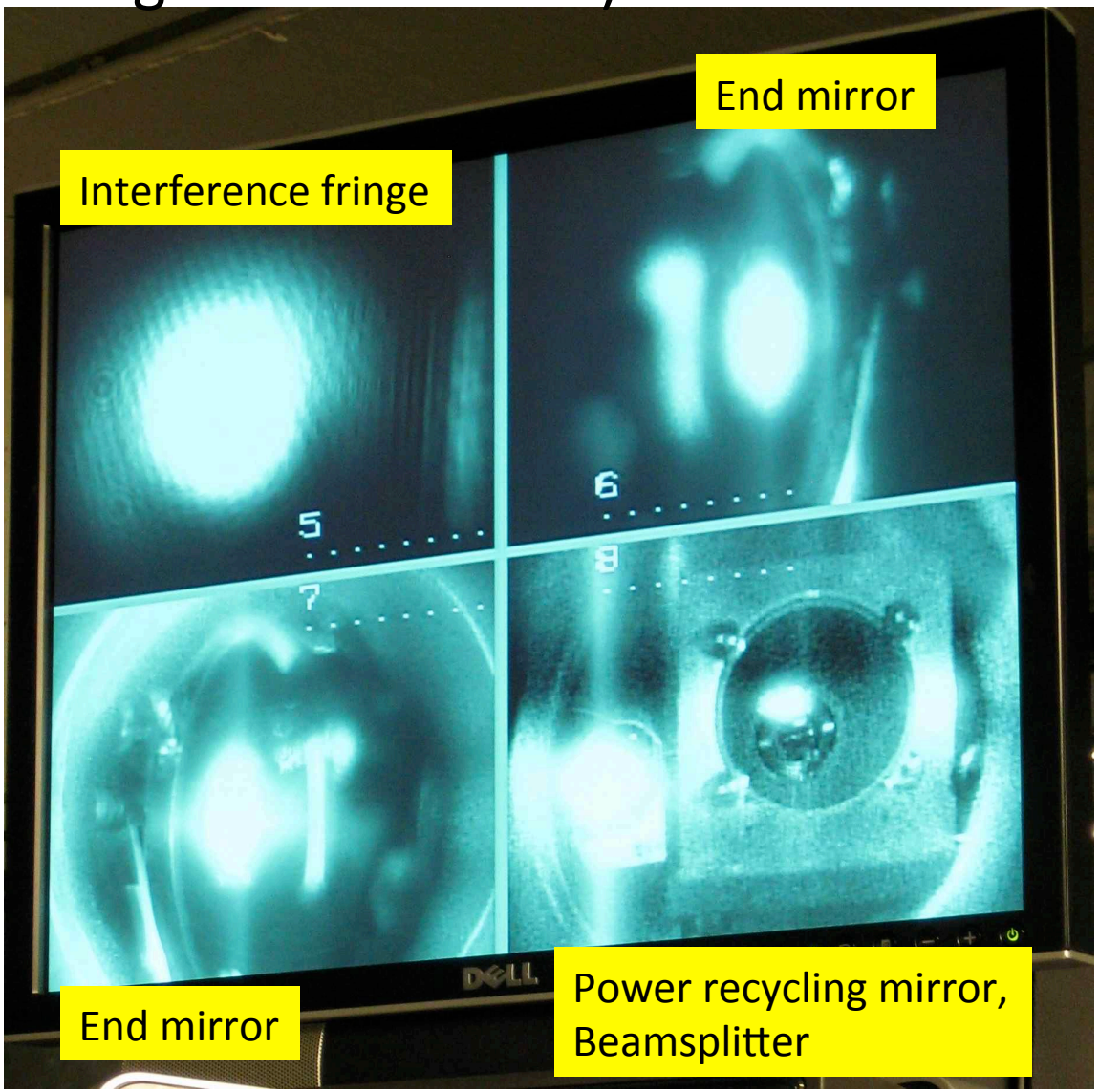
(where the signal is the noise)

1) Both interferometers operating at design luminosity of 1.15kW. (Injected 1.15W beam is recycled 1000 times inside the cavity.)

Current control system work:

- automated lock acquisition
- improving stable operations beyond ~10 minute lock

2) Data acquisition system is operating at design noise sensitivity.



Holometer Commissioning Status

Contrast Defect from Beam Halo

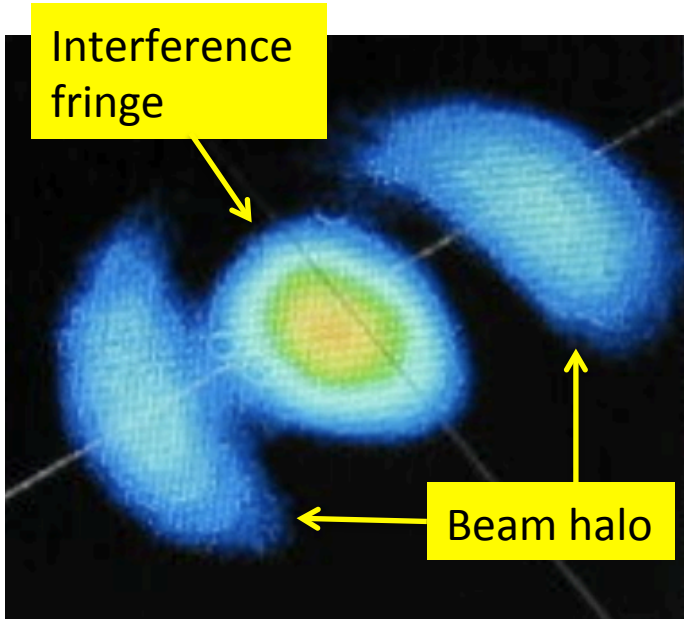
3) Astigmatism in optics is causing mismatched beam sizes. This produces a halo of non-interfering leakage light (142ppm, 560ppm) in the two interferometers.

The photodetectors are limited to 50mW of halo power, so the usable cavity power is limited to (350W, 90W). **The deficits from 1.15 kW costs a factor of 42 in integration time (9 minutes → 6 hours)!**

Currently pursuing 3 methods for mitigating the beam halo:

1) Mechanical iris to block halo
2) Optical fiber-based mode cleaner
3) Installing new optics (a few spares available now, more spares to be delivered in Summer, 2014)

→ Expect rapid improvements.



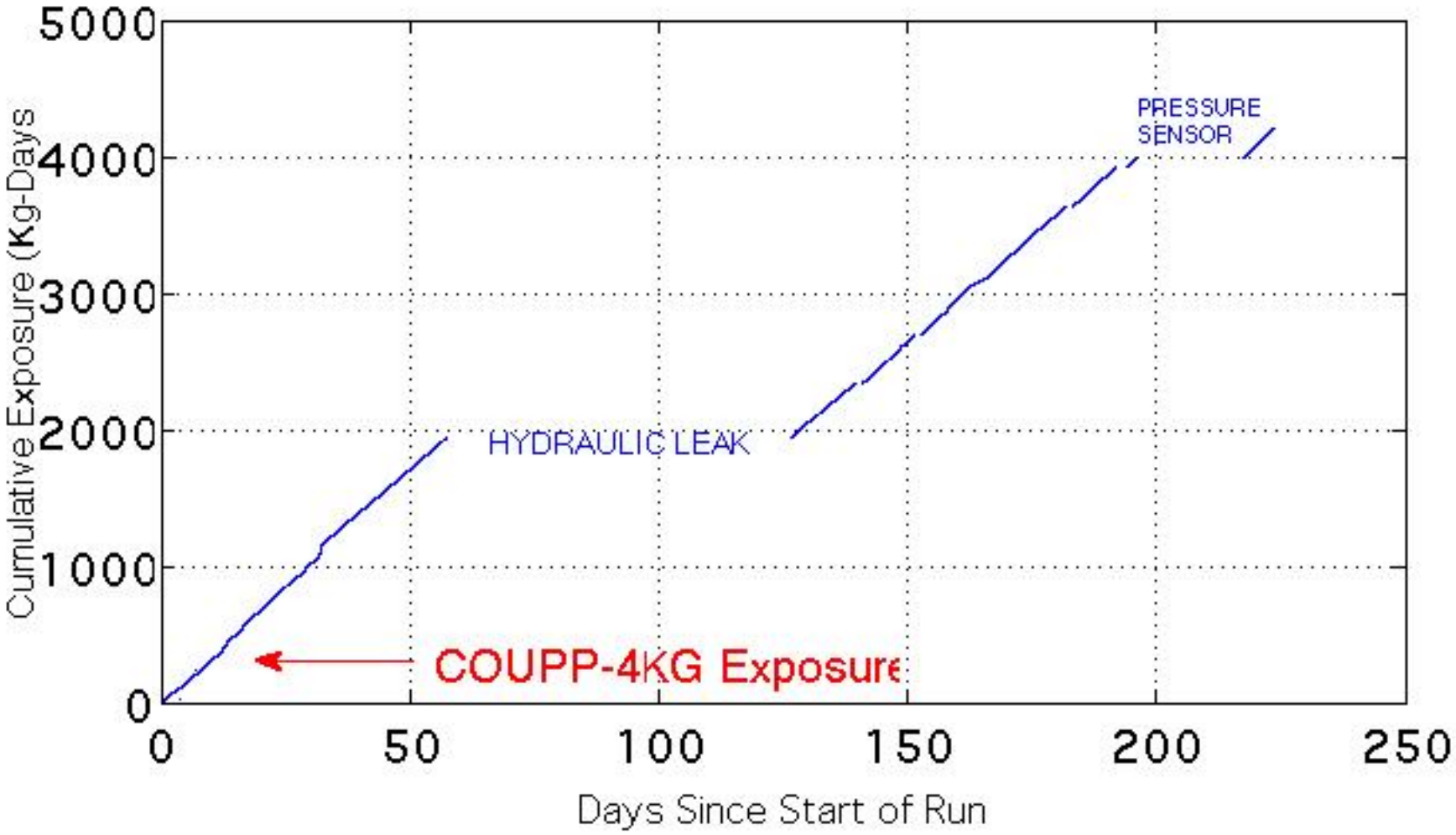
COUPP/PICO Operations Summary

(Bubble chambers for all types of dark matter)

- COUPP-60 Filled with 37 kg CF3I target liquid at SNOLAB, April 2013. Start of physics run, June 20, 2013. Run is continuing, with the following interruptions in data taking:
  - Repair of glycol hydraulic fluid leak to water tank: Aug. 9- Oct. 31, 2013.
  - Repair broken pressure sensor in water tank: Dec. 24- Jan. 14.
  - Excess video noise Jan. 22→ today.

- PICO-2L is a 3 kg C3F8 bubble chamber dedicated to low mass & spin-dependent WIMP search. Run started October 2013 and is continuing with interruptions:
    - Hydraulic leaks (Dec. 23- Dec. 31)
    - Piezo acoustic sensor shorting problem (Jan. 16→ today)

COUPP-60 Exposure Vs. Time

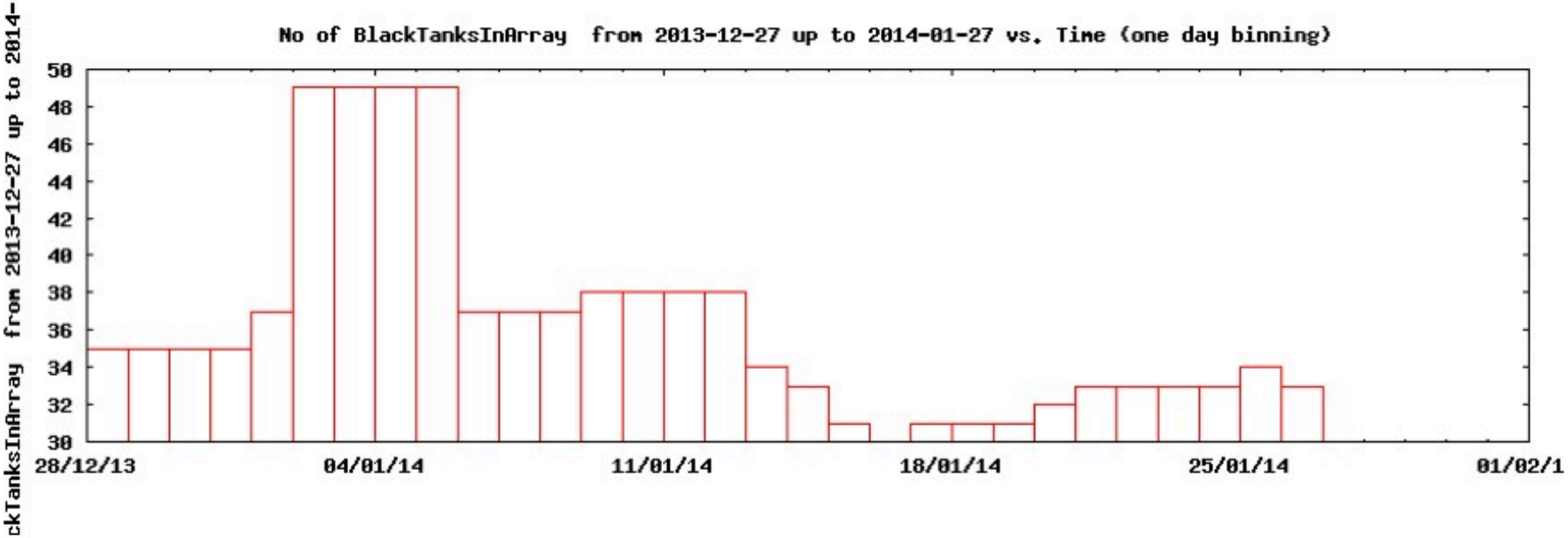


Pierre Auger Observatory

- Surface detectors (SD): 1600+ water Cherenkov detectors - ongoing observation
- Fluorescence detectors (FD): 27 telescopes on 5 sites - data taking depends on moon cycle

Activities of the past month/two weeks

- SD efficiency: 96.84% in the past two weeks
  33 out of 1652 detectors inactive (“black tanks”)
- Recent FD observation period: Dec 26 (2013) - Jan 9, Jan24 - Feb 8 2014
  no error, smooth running
- 1 new full-authored publication within the past month



DarkSide-50 Status

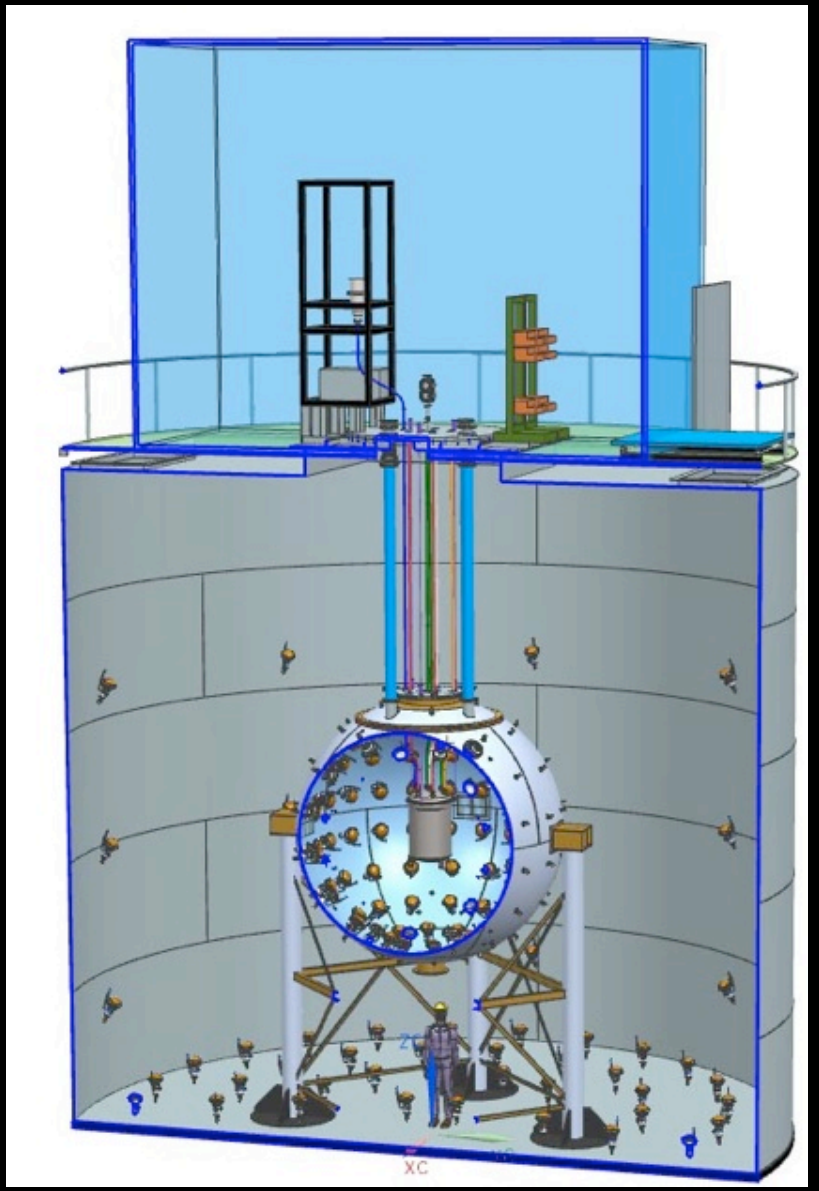
Detector Fully Commissioned

High Statistics studies of 39Ar rejection in progress (equivalent to full 3 yr DS-50 run)

DAQ in impressive shape

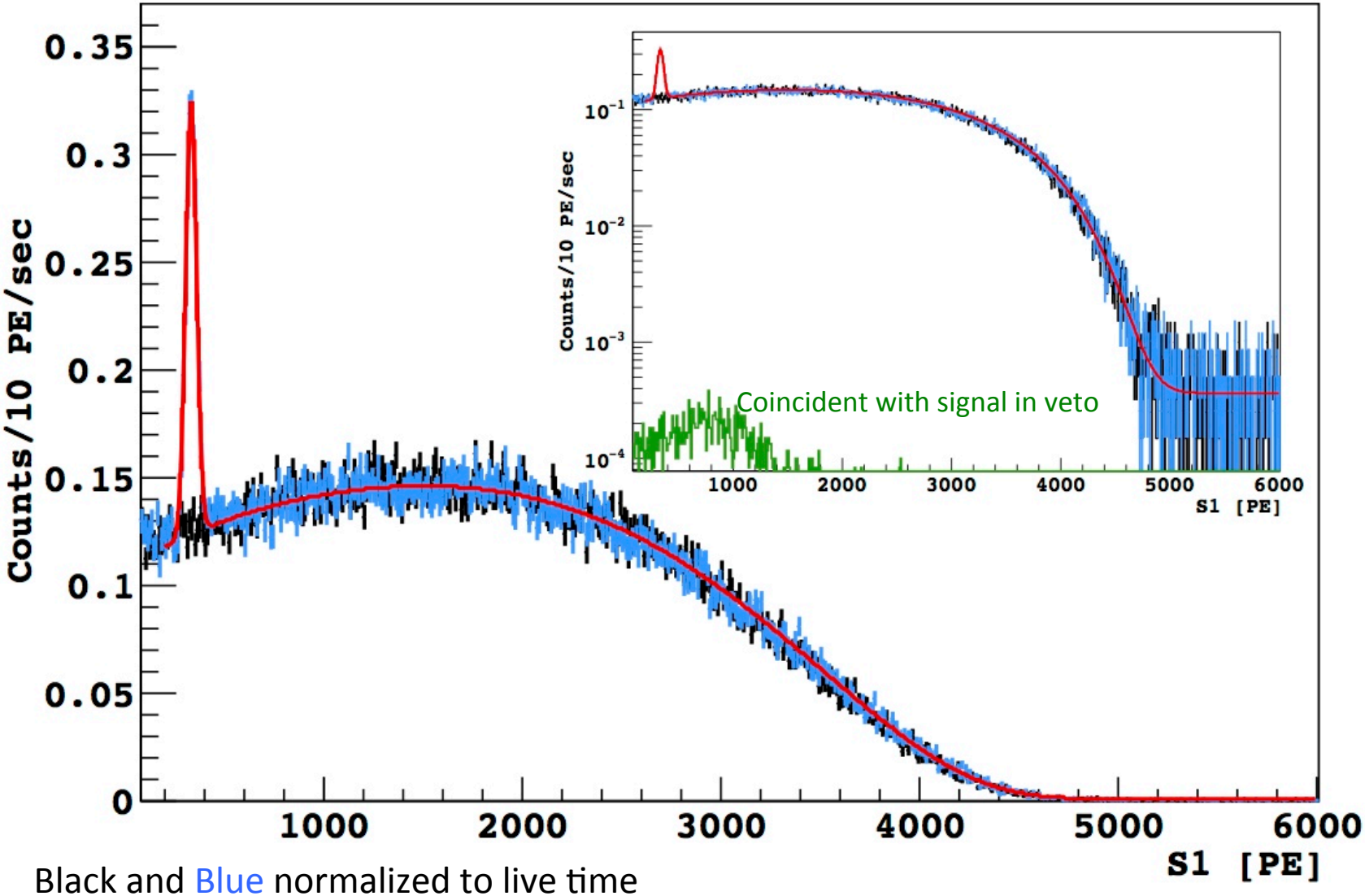
56 TB data transferred from Italy to FNAL

Reconstruction on Fermigrid



Pulse size distribution from runs with (and without) krypton diffused inside argon

black – 39Ar; blue – 39Ar + 83Kr; red – fit to 39Ar (known spectrum) + 83Kr



Black and Blue normalized to live time